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Various Forms of Trichomes of Echinocystis lobata.—In reexamining recently the results of a study of the anatomy of *Echinocystis lobata*, Torr. & Gr., made some years ago, my attention was attracted to the variety of shapes which its trichomes assume. The diversity is the more unexpected because the plant is "nearly smooth,"* speaking accurately, and what pubescence there is would usually be overlooked.

Of course, the roots near their tips are provided with the well known, delicate, one-celled root-hairs, which are so abundant and long that when a plantlet is pulled from the ground it brings with it quite a weight of soil.

Few hairs are found on the stem except at the growing extremities. In these places they are numerous, and of two shapes—filiform and capitate. Individually they are minute and delicate although forming a slight pubescence when taken as a whole. They are so evanescent as to rarely persist after the growing point of the stem has extended a few centimeters beyond them. The filiform hairs (Pl. I, M, lt) are composed of a single row of terete cells, in which movements of the protoplasm may often be detected under favorable circumstances. They arise from above a hypodermal tissue of collenchyma. The capitate form (Pl. I, M, st) springs from a parenchymatous hypodermal tissue containing chlorophyll. They are much shorter than the first, and consist of a head of two or four large cells side by side supported on a stem of smaller cells. They are more abundant than the filiform ones but less persistent. In general, taking the whole plant into consideration, the filiform ones occur upon projecting portions of the surface, the ridges and edges, which are firm and without stomata : such are the margins of the leaf, the angles of the stem, and the edges of the perianth-cup. There are two exceptions to the rule, for they are also found sparingly both on the flat surfaces of the leaf, and on the exterior of the perianth-cup. The capitate form springs from stomatic surfaces, e. g. channels of the stem, upper and under surfaces of the leaf, exteri r of the perianth cup, etc., while within the perianth cup, and on the petals are modified forms (described below) of the same type.

Full grown leaves are minutely scabrous upon both surfaces from the presence of short, thick, and rigid trichomes, which are sometimes tipped with a minute mucro (Pl. I, B).

A very copious supply of delicate glandular hairs (Pl. I, G) upon all sides of the petals gives to them a soft velvety appearance.

*Gray's Manual, 5th ed., p. 186: "nearly glabrous," Fl. North Amer., Torrey & Gray, V. 1, p. 542.

The inner surface of the perianth-cup has numerous flat-heaess-trichomes (Pl. I, F), which have the cells of the short stalk comprded ed vertically like circular plates, and the four or six slightly inflated cells, which at first compose the head, often changed into a head of many cells by formation of vertical, radial partitions. In the closely related *Sicyos*, these flat-headed trichomes are so densely pressed together over the bottom of the cup, that in a cross section it appears at first sight to have a second undulating epidermis supported on short pillars.

Each one of the prickles of the young ovary is tipped with a solitary trichome (Pl. I, E), like the capitate ones of young shoots. but much larger, so large in fact that they can be discerned by the unassisted eye. These disappear soon after fertilization, while the prickles continue to grow. The calyx-teeth and the lobes of the very young leaves, which have the same histological structure and appearance as the prickles on the ovary, are not thus equipped.

There are scattered some trichomes of peculiar form among the sort next mentioned. They consist of one comparatively large cell with reticulated thickenings (Pl. I, D), tipped with a small pear-shaped cell. They are straight and rigid but rarely stand upright owing to a weak base.

All the free surface of the connectives, i. e. the surface of the anthers not occupied by the thecæ, both at the apex and sides has the epidermal cells produced into incipient trichomes (Pl. I, A). Their origin and form, and the fact that they are not united laterally, entitle them to this classification. The slight cuticularization of their apices, and total absence of ordinary epidermal cells indicate their near alliance with true epidermis.

A still more curious transitional form is presented in the epidermal tissue of the upper surface of the cotyledonary petioles (Pl. I, H). The epidermis, which is underlaid with a hypoderma of firm collenchyma, presents the anomaly of not being cuticularized. Its cell-walls continue an unequal growth and meeting no outward resistance expand their free surfaces piloseiy. The longer cells divide and become several-celled filiform trichomes. In *Cucurbita* the cotyledonary petioles, having the usual cuticularized epidermis, are extremely short, and entirely distinct from each other; *Echin cystis* has the petioles longer and slightly connate; while *Megarrhiza* has very long petioles which are connate throughout, forming a tube. It seems quite reasonable to presume that the upper (inner) surfaces of the cotyledonary petioles of *Megarrhiza* will be found upon examination to be still more strongly pilose by transformation of the epidermis, than those of *Echinocystis*, because of the more perfect protection from environmental influences.

The last example shows a natural transition to trichome-like outgrowths arising from a surface without epidermis. Such were found (Pl. I, C) projecting into the central cavity of the hypocotyledonary stem of an old plant. The wind had twisted the stem so as to rupture it and expose the inside to the weather. Some of the cells of the in

ner surface had expanded, under these changed conditions, into corpulent pseudo trichomes with irregularly thickened walls.

Still more remotely related to true trichomes are the hernioid cells* found in the large vessels of the older roots. They are formed by the local surface growth of a cell-wall lying in contact with a pitted duct, so that the cell-wall, aided by pressure of the cell contents, is forced through the opening of the pit into the cavity of the duct, where it makes a bladder like expansion.

Ovules are in some species of plants considered to be metamorphosed trichomes. But such is evidently not the case in this instance, for the reticulated venation, characteristic of Cucurbitaceous seeds, shows them to be unequivocably homologous with a portion of the leaf-blade.

All the forms mentioned in this article fall under one of two classes, capitate or filiform. Trichomes of the former class are inclined to be glandular while those of the latter are not. This accords well with their distribution over the plant surface. The filiform ones contain the more highly vitalized protoplasm, as manifested by its activity. They are situated on the parts of the plant which are destitute of stomata and growing rapidly, and consequently in need of some other means of directly absorbing water and oxygen from the atmosphere and soil. On the other hand the capitate forms are on surfaces well provided with breathing-pores. The latter serve to absorb oxygen during the earlier stages of growth, while the stomata are inefficient. When the stomata perform their allotted function, and the intercellular spaces are free of sap and protoplasm, these capitate trichomes become glandular and are turned to other service, or disappear.

Considered physiologically, trichomes are not indispensable to the plant, yet in a small way frequently render important assistance. The value of the root hairs is one of the best known facts in Botany, being uniformly illustrated in general treatises, and insisted upon in horticultural essays on transplanting. Hairs on many plants serve for protection against detrimental changes of the weather, the attacks of animals, etc, but in *Echinocystis* the only trichomes that could be considered protective are those which roughen the leaves. Upon rapidly growing parts (especially true, e. g., of young flower-buds) the abundance of delicate trichomes aids in supplying oxygen to the tissues. Stomata and air cavities perform this office in the older portions, but in parts newly formed the cavities are filled with protoplasm and cell sap, so as to prevent free circulation of air. Moreover, a very rapid supply of oxygen is required at this time to meet the needs of metastasis by which the increase of protoplasm and the formation and multiplication of cells is effected. The oxygenation of the plant in such growing parts is somewhat analogous to that of some polyps and worms having external filamentous gills, while later it assumes the more efficient internal respiration corresponding to that of insects.

It has already been hinted that there is a similarity of function between the hairs of growing shoots and of young roots. Both subserve

*Illustrations of these are given in Bessey's Botany, p. 30.

the interests of the plant by increasing the surface through which material for the plant's sustenance and growth may be absorbed. The character of such material is determined by the nature of the respective media in which the organs vegetate—of shoots it is gaseous, of roots aqueous.—J. C. ARTHUR, *Univ. of Wis.*

EXPLANATION OF PLATE.—Trichomes of *Echinocystis lobata*, Torr. & Gr.: drawn with camera lucida; uniformly magnified 250 diam.

A. Vertical section of androecium; the epidermal cells transformed into trichomes.

B. Short rigid hair from surface of mature leaf.

C. Cell from interior surface of an injured hypocotyledonary stem; free portion of the cell-wall irregularly thickened; a pseudo-trichome.

D. Reticulated trichome from surface of androecium.

E. Capitate trichome on the point of a prickle of the ovary; inclined to one side, as is common.

F. Flat-headed trichome from interior surface of perianth-cup; seen in perspective.

G. Trichome from surface of petal; its head somewhat glandular.

H. Vertical section of upper part of a cotyledonary petiole; epidermis changing into thin-walled hairs.

M. Transverse section near the apex of a growing stem; *lt* filiform, and *st* capitate trichome.

New Plants of New Mexico and Arizona.—TALINUM HUMILE.—Acaulescent, glabrous and very succulent; root with an oblong orange-colored tuber an inch long; leaves terete, 2–3 inches long, lying flat upon the ground; the dichotomously branched scapes only half as long as the leaves, 5–10 flowered; sepals pointed; petals light yellow, changing to orange in drying; seeds black, marked with circular lines.

On a rocky table land near the southern base of the Pinos Altos Mountains, New Mexico, Aug. 11, 1880. The plant is probably rare, as only some eighteen specimens could be found. The flowers at 2 o'clock p. m. had not yet opened, hence it is one of those species whose flowers open at evening and close in the morning. In habit it is much like *Calandrinia pygmæa*; it has the color and the seeds nearly of *T. aurantiacum*, but is most distinct from that species, by its habit, and its succulent herbage.

LINUM NEO-MEXICANUM.—Annual or biennial, glabrous and glaucescent; stems 1–2½ feet high, branched from the base, the branches very strictly erect and narrowly paniculate for more than half their length; lowest leaves opposite, and when viewed from above showing a cruciate arrangement, the upper alternate, all lanceolate, or oblong, acute, sessile, entire; pedicels 3–6 lines long, with marginal angles; sepals broadly lanceolate, scarcely equalling the capsules, the margins sparingly glandular denticulate; corolla a half inch in diameter, light yellow; styles free to the base; capsule incompletely 10 celled.

In woods of *Pinus ponderosa* on the Pinos Altos Mountains, New Mexico, August and September, 1880. A tall, graceful species, with sometimes almost racemose inflorescence.

BIGELOVIA (APLODISCUS) RUPESTRIS.—Less than a foot high, much branched from the base, woody and brittle; flowering branch

lets short and very leafy ; leaves a half inch long, obovate-lanceolate, entire, ending with an abrupt sharp point, veinless, coriaceous, very punctate on both sides with rather coarse, dark, resinous dots; bark of the green, leafy branchlets minutely warty, and the branches of the dense corymb clothed with small, triangular scales; heads a half inch long, about 12 flowered; the innermost scales of the turbinate involucre linear lanceolate, the outer gradually shorter, all rather acute, with minutely barbellate, scarious margins; style appendages subulate about equaling the stigmatic portion; the short, subturbinate akenes silky villous.

Growing in dense hemispherical tufts from crevices of perpendicular cliffs which crown the highest San Francisco Mountains in Arizona. In flower Nov. 1, 1880.

From the description of *Bigelovia spathulata* of Lower California this new shrub of Arizona must be its nearest ally.

BIGELOVIA (CHRYSOTHAMNUS) JUNCEA.—Shrubby, much branched, cinereous; branches closely fastigiate, very slender and straight, fastigiate-corymbose at summit; leaves very few, linear-filiform, or none; involucres five-flowered; scales very strictly five-ranked, the outermost short ovate, the inner linear lanceolate, all obtuse at apex; akenes slender, five-angled, minutely but rather densely pubescent; pappus of slender, scabrous, unequal bristles.

Calcareous bluffs of the Gila River in eastern Arizona very near the New Mexican boundary, in flower Sept. 5, 1880.

A very compact shrub, at time of flowering wholly leafless and reedy looking. It is very closely allied to *B. Bigelovii*, Gray, of Northern New Mexico, but of quite different aspect, with its much more slender, more numerous, and greener branches; while the pubescent akenes mark it as clearly distinct.

HIERACIUM CARNEUM.—Stem 2 feet high, simple, leafy up to the base of the ample, loose corymbose panicle, glabrous; radical leaves from ovate to oblong lanceolate densely clothed with long, coarse, somewhat appressed white hairs, the cauline lanceolate and all except the very lowest, smooth and glaucescent, all sessile; peduncles an inch long, minutely bracteolate; the scarcely calyculate involucre glabrous; achenia columnar, very slightly attenuated at summit; pappus bright white; flowers deep flesh color.

South base of the Pinos Altos Mountains, New Mexico, in woods of *Quercus hypoleuca* and *Q. Emoryi*, flowering in October, 1880. A remarkable species of its genus both on account of its flesh-purple flowers, and the strong contrast between the radical and the cauline leaves, the former being white with long wooly hairs, the latter perfectly smooth and a little glaucous It is perhaps most nearly related to *H. albiflorum* which ranges farther north and west.

EUPHORBIA (ANISOPHYLLUM) VERSICOLOR.—Annual, prostrate, the red stems pubescent with soft, spreading hairs; leaves less hairy, round ovate to oblong, 3 lines long, rounded above, slightly cuneate at base, on petioles a line or more in length; stipules none; involucres solitary in the axils and at the ends of the branchlets; glands erect, purple, their appendages cuneate-obovate, to nearly quadrangular,

white changing to deep rose-red; styles bifid to below the middle; capsules pubescent, angled; seeds light ash colored, short oblong, acutely 4 angled, transversely rugose.

Canons of the San Francisco Mountains, Arizona, September 1880.

Very closely related to *E. setiloba*, Engelm, but a larger plant, (forming mats often more than 2 feet across) less leafy, (the internodes an inch long) and less closely appressed to the earth; the seeds also are of a different color, those of *E. setiloba* being more of a reddish gray; but the most obvious distinction is in the appendages of the glands, which, in the species last named, are divided into three setiform lobes; whereas in *E. versicolor* they are nearly always entire, rarely retuse or erose. These appendages in both species undergo a change of color; but that change is most marked in the new one.

TRADESCANTIA TUBEROSA.—Stems solitary from a horizontal, jointed, tuberiferous rhizome, 6 to 12 inches high, simple, slender, retroversely puberulent; leaves narrowly linear, rather fleshy, not open; sheaths ciliate; umbels terminal few or many flowered; pedicels and sepals glandular hairy; corolla purple.

Pinos Altos Mountains, New Mexico, in flower August 23, 1880.

The plant would readily pass for a form of *T. Virginica*, which is also common in the same region, but for its entirely different root and habit of growth. The yellow tubers, borne singly or by twos and threes, at the joints of the rhizome, are oblong, an inch or more in length, and obtuse at both ends. My correspondents have received specimens of this plant under another name, which I hereby beg them to erase; substituting the one here given.—EDWARD LEE GREENE.

The British Moss-Flora, By *R. Braithwaite*, M. D., F. L. S. &c.—So large a proportion of the North American Mosses are identical with those of Great Britain that the present work may well be commended to American botanists. It is issued in parts, as was Schimper's *Bryologia Europæa*, and it apparently yields in no respect to that great work in the character and completeness both of the letter press and the plates. But it promises to be of moderate extent, the price is certainly moderate, and the text is entirely in English. The mosses are taken up monographically, family by family in a natural arrangement, this arrangement being essentially that recently proposed by Lindberg. Parts 1 and 2 have only two plates each; but the third, a monograph of the *Polytrichaceæ*, has four, which illustrate fifteen species. It is intended to go on with four plates to each fasciculus, and to charge at the rate of a shilling a plate, including all letter press, and this runs at the rate of a page or two to each species. At this price remitted to the author, at 303 Clapham Road, the work will be sent post paid to subscribers in the United States. Publishers do not like to meddle with works like this, of limited sale and occasional issue in detached parts, so the author, to whom this is a labor of love, acts as his own publisher, and is glad to receive subscriptions directly. Certainly he spares neither pains nor expense. The work is as beautiful as it is excellent and thorough. It is in imperial octavo, descrip-

tions, references and synonymy full; the drawings, all by the author's own hand, may challenge comparison with those of Sullivant, and the lithography does them justice. This moss-flora is appropriately dedicated: "To the memory of the late William Wilson, the greatest of British Bryologists."—A. GRAY.

Botanical Charts.—For the benefit of any readers of the GAZETTE who are teachers of Botany I wish to give a brief description of a method of preparing botanical charts which may be of great service in illustration of the subject. While recognizing the fact that the only proper way to teach the science is by actual dissection and demonstration under the microscope I also know the fact that many have to teach botany in the best way they can without microscopes. Even to those whose departments are well supplied these charts may be helpful in illustrating a course of lectures, in the class room or to popular audiences I have never seen anything similar in use and believe that they are here first described.

Prof. L. S. Thompson in charge of the Department of Industrial Art of Purdue University after considerable experimenting to find a cheap, easily made and convenient chart for use in his class-room has determined upon this form as being in every way the best. Seeing them there I have constructed a number for use in botanical instruction. By his permission I here describe them hoping they may be of use in the sciences as well as in art.

Sheets of strong smooth manilla paper (the quality used for genus covers is the best but a little more expensive than necessary) 40×48 inches are to be had at any book store or paper house. These cut along the fold make a convenient size 24×40 or if larger is wanted a sheet 36×48 left uncut is most suitable. On these the illustrations to be used may first be sketched in pencil and then completed in India ink. Crayon may be used and if it shows any tendency to blur (as it usually does when handled) may be sprayed with a solution of shellac in alcohol by means of an atomizer. As this is troublesome India ink is preferable. Very frequently students with time and talent enough can either do the whole of the work or the preliminary sketching. Experience will dictate the best illustrations, such as Figs. 123, 219, 224 and 565 in Gray's Structural Botany; 18 a, 26 and 77 from Sachs and 53 73 and 302 from Bessey are easily put on and serve a good turn in demonstration.

Having completed a sufficient number of charts procure the round pine sticks used for curtain rollers, a shoemaker's eyelet punch and fastener, a few eyelets and a few small screws. Along the top edge of a series of charts (twenty five is a convenient number) punch four or five holes, insert and fasten the eyelets and you have them securely bound together. It is well, to prevent the tearing off of the outer chart, to fasten in the holes small bits of tin thus giving greater bearing surface to the rim of the eyelet. Now with the small screws fasten the bunch to the roller and the work is done.

For supporting these charts a light frame tripod with a cross piece at the top furnished with hooks at suitable distances to catch into corres-

ponding "eyes" on the roller is used. As the under charts are wanted the upper ones can be thrown over the top and out of the way.

A word in regard to the preparation of the India ink. If you follow the ordinary directions, viz: to rub down the quantity needed in a porcelain dish, after grinding away till your arms ache, you will have enough perhaps to outline one illustration and probably half of that will evaporate before you are ready to use it. Instead, take about half a stick break it into pieces the size of a grain of wheat and allow it to soak over night in just enough water to cover it. When you are ready to use dilute until it will just leave a perfectly black mark. If at all lumpy rub to a smooth paste with a flat ended stick. Apply with a camel's hair or sable brush —one tapering to a fine point will be found easiest to handle. Let me assure any who care to attempt the manufacture that it takes very little artistic talent, very little time and very little trouble to produce results that will astonish the maker. (No sarcasm) These charts are cheap, portable and efficient; qualities possessed by none of the more elaborate ones of the publishers. I shall be glad to give any further details of construction if any one so desires. —C. R. BARNES, *Purdue Univ., La Fayette, Ind.*

The Flora of Essex County, Massachusetts, John Robinson, Essex Institute, Salem, 1880. —An elegant Catalogue of 200 pages. Those who are familiar with Prof. Robinson's methods will not need to be told that this Catalogue is a most thorough and admirable work. No finer Catalogue has been published since Paine's model catalogue of the plants of Oneida County, N. Y., and could the lamented Oakes, to whose memory it is so gracefully dedicated, have lived to see this tribute to the flora of a region "where he was born, and where he loved to botanize," his pleasure would have been very great indeed

Tracy's modest "Studies of the Essex Flora" was only partial in its character, being limited to the vicinity of Lynn, and containing only the flowering plants of that region; but the present Catalogue covers the entire County, and contains the lower, as well as the higher orders of plants.

Combining within her limits sea shore and wood land of varied character, Essex County offers rare attractions to a botanist, and how well sea-shore and wood land, meadow and hill have been gleaned for treasures this splendid record attests. 1694 species and 140 varieties are enumerated representing 115 orders.

The remarkable resemblance between the wood lands of Essex and those of New Hampshire has often been noticed by visiting botanists, and it is not surprising to find recorded here many plants common to both regions.

The writer has passed many pleasant hours in the Essex woods with the author, the recollection of which he will long cherish, and it gives him much pleasure now to bear witness to the zeal and fidelity with which the author has devoted himself to this work of the "Essex Flora," the completeness with which it has been consummated, and the very elegant form in which it is presented.

Full credit is given to all who have aided the author in any way,

and the names of Gray, Watson, Goodale, Farlow, Austin, Halstead, Faxon and Collins ensure accuracy of determination.

The Catalogue will serve to stimulate the botanical section of the Middlesex Institute which has in contemplation the publication at an early day of a complete Catalogue of the Middlesex Flora.—G. E. D.

Notes from Arkansas.—Hearing of some very large trees of Chinquapin in Arkansas, that were reported as 15 and 18 inches in diameter, I went to see them on the Washita river.

The tree is not uncommon about Hot Springs, Ark., near the base of the mountains many were seen that appeared to be 12 or more inches through and one that was carefully measured gave a circumference of six feet plump, which is equal to two feet diameter at stump high. I was informed that they were used in some places for rail timber, but all that I saw were low headed and could furnish but one cut for such purpose.

When conversing with Dr. Engelman respecting these trees he reminded me of a mistake made by a distinguished botanist, who having heard of these trees, and possibly seen them in the winter mistook them for *Castanea vesca*. It is still believed that our chestnut is not found west of the Mississippi.

In the same region *Magnolia tripetala* was seen of large size, reaching a diameter of eight inches.

About Hot Springs the pines were all *P. mitis*, and the line of the St. Louis, Iron Mt. and Southern Railway about Malvern Station seemed to be the meeting place of *P mitis* and *P. australis*, upon the borders of the metamorphic rocks and the Cretaceous and Tertiary formations. Near this latter place the *Magnolia grandiflora* and *Ilex opaca* are found. Near Hot Springs seven oaks were seen; *Q. alba*, *Q. Muhlenbergii*, *Q. nigra*, *Q. falcata*, *Q. tinctoria*, *Q. rubra*, *Q. obtusiloba*. *Q. imbricaria*, at Iron Mt., Mo., had leaves 8⅝ inches long including the short petiole, by 5¾ inches wide.—Jno. A. Warder, *North Bend, Ohio.*

Rudbeckia rupestris, n. sp.—Stem (3°–5°) and leaves sparingly hairy, branches elongated and terminated by single large heads; upper leaves ovate lanceolate, coarsely serrate, sessile, partly clasping, the lower 3 parted, with deep rounded sinuses, the lower lobes standing out almost halberd shaped, with margined petioles, the lowest 4′ in length and breadth, on long petioles (3′), radical leaves undivided, rhomboid-oval; disk large (¾′), globular, black purple; rays 10–13, 1′–1½′ long, linear-oblong, uniform orange yellow; involucral scales few, spreading, long lanceolate, hirsute, leaf like; chaff of the disk toothed tapering into a slender awn.

Differs from *R. triloba* in the thicker, larger and more halberd shaped leaves, in the fewer (3-5) but much larger heads, and longer rays with no change of color near the disk; and from *R. subtomentosa*, in its smoother, thicker, and broader leaves, in the color of the rays, and in the awned chaff of the disk.

Found abundantly on the rocky slopes of "Little Roan," N. C.,

at an altitude of 5500 feet, in company with *Liatris spicata*, *Melanthium Virginicum*, and *Delphinium exaltatum*.—J. W. CHICKERING, *Washington, D. C.*

Ferns of Arkansas.—An exhaustive list of the ferns of Arkansas having never been published, but little is known by fern specialists of the representatives of this order in this State. Having been urged by several correspondents to prepare a list, we take great pleasure in presenting our observations, up to date, to the GAZETTE for publication, that they may reach a greater number of botanists.

The varied physical features of Arkansas give a wide range of habitat.

Upon the dry calcareous cliffs of the mountainous region, with a south exposure, are found the conditions favorable for the growth of such genera as *Cheilanthes*, *Notholæna* and *Pellæa*.

The mountain gorges of N. W. Arkansas, shaded from the direct rays of the sun are favorite places for shade and moisture loving genera, such as *Polypodium*, *Asplenium*, *Adiantum*, *Camptosorus*, *Cystopteris*, *Woodsia* and some species of *Aspidium*.

In open woods, in dry calcareous soil, *Phegopteris* and *Pteris* are found.

The low rich woods and swamps invite *Osmunda*, *Botrychium*, *Ophioglossum*, *Woodwardia*, *Onoclea*, and some species of *Aspidium* and *Asplenium*.

We are able to report *forty* forms (including varieties) as the present number of ferns known in Arkansas. An exhaustive list is not claimed, as each year's research has been rewarded by one or two species, and probably more will be found.

The order is well represented in this State by seven of the ten tribes of *Polypodiaceæ* and a range of twelve genera, besides *Osmundaceæ* and the two American genera of *Ophioglossaceæ*.

The following list is arranged in accordance with the excellent "Fern List" by Prof. D. C. Eaton recently published.

ORDER FILICES.

SUBORDER POLYPODIACEÆ.

TRIBE ACROSTICHEÆ.

(Not Represented.)

TRIBE POLYPODIEÆ.

1. *Polypodium vulgare*, L.—N. W. Arkansas, upon rocks in shaded damp situations Grows large and thrifty. Seems to prefer sandstone, though it grows on moss covered trees near shaded cliffs. Never found on limestone in this region.

2. *Polypodium incanum*, Swartz.—Found sparingly, in depauperate form, in N. W. Ark., upon the escarpments of sandstone cliffs near permanent moisture. S. Ark. upon moss covered trees abundantly. The specimens are large and well developed. Grows luxuriantly upon the shaded sides of low trees with horizontal branches.

TRIBE GRAMMITIDEÆ.

3. *Notholæna dealbata*, Kunze.—N. W. Ark., abundantly, upon the

escarpments of limestone cliffs with a south exposure. It seems to prefer isolated masses of limestone, separated from the main cliff by land slides.

TRIBE VITTARIEÆ.

(Not Represented.)

TRIBE PTERIDEÆ.

4. *Cheilanthes Alabamensis*, Kunze.—Distributed throughout the mountainous region of Arkansas upon limestone ledges only. Usually in comparatively dry situations, though found in shaded places and niches of rocks where it grows larger. This species flourishes upon the tufa ledges, deposited by the Hot Springs in Garland Co. in very moist places. Inland and along streams.

5. *Cheilanthes vestita*, Swartz.—Throughout the N. and W. part of the State upon the flat tops of sandstone ledges, generally, but sparingly in similar situations upon limestone. Plentiful inland and also upon the river cliffs.

6. *Cheilanthes lanuginosa*, Nutt.—Grows quite plentifully, in only one known situation, in N. W. Ark. It is found on limestone cliffs, upon the N. and E. sides of valleys running inland from White River. Though loving the light, it grows larger when protected by projections. Its habitat is similar to that of *Notholæna dealbata*, though they have never been found together. The species may be regarded as scarce in Arkansas.

7. *Cheilanthes tomentosa*, Link.—Sparingly in N. W. Ark. upon limestone cliffs. Plentiful in the mountains of the S. W. part of the State. It grows in dry situations upon sandstone, shale and limestone. It is most abundant high up the hills near the base of ledges facing the south, but can be found on limestone cliffs sparingly, or in moist valleys upon all formations.

8. *Pellæa atropurpurea*, Fee.—Plentiful throughout the upland portion of the State, upon the escarpments of sandstone and limestone ledges with a south exposure. Grows inland upon the cliffs of eroded valleys, as well as along streams.

9. *Pteris aquilina*, L.—Occurs in the N. W. part of Ark. upon hills and prairies, but the most common form is:

var. *caudata*, Hooker, which is found all over the S. part of the State on the ridges and is known as "Upland Fern."

10. *Adiantum Capillus-Veneris*, L.—Throughout the N. and W. part of Ark., upon both lime and sandstone cliffs, in situations affording perennial moisture.

The finest specimens found in the U. S. (of this species) grow in N. W. Ark. upon shelving sandstone ledges of White River, between high and low water mark. It grows on the calcareous tufa ledges at Hot Springs. Nothing in the foliage of plants could excite more admiration than a crevice for several hundred feet adorned by an uninterrupted line of these graceful drooping ferns.

11. *Adiantum pedatum*, L.—Throughout N. and W. Ark. in the upland country. It grows most luxuriantly at the base of shelving sandstone cliffs in shaded and damp situations, but is also found along shaded moist ravines in rich woods.

Prenanthes (Nabalus) Roanensis, Chickering.—In view of the fact that Bentham and Hooker have merged the genus Nabalus in the older Prenanthes. which revision will undoubtedly stand, I would change the name of *Nabalus Roanensis*, n. sp., described in BOTANICAL GAZETTE for December 1880, to that given above.—J. W. CHICKERING.

Recent Periodicals.—*Trimen's Journal of Botany* for January contains the following original articles: On *Chara obtusa*, Desv., a species new to Britain. by Henry and James Groves, accompanied by plate 216; The History of the Scorpioid Cyme, by Sydney H. Vines; on *Potamogeton lanceolatus* of Smith by C. C. Babington; Musci Præteriti, (continued) by Richard Spruce; on the Plants of (North) Aran Island, Co. Donegal. by Henry Chichester Hart.

Nature in its four numbers for January gives the following papers to the botanical public: A chapter in the History of the Coniferæ, II, by J. Starkie Gardner, in which is considered the Ginkgo or *Salisburia*; Dr. Maxwell Masters on Dimorphic Leaves of Conifers.

Hardwicke's Science Gossip for January and February contains "Botanical notes from the Swiss Highlands;" "Notes on some of our smaller fungi," illustrated; "Science-Gossip Botanical Exchange Club Report for 1880;" "Notes on Terminal and Subterminal Buds."

American Naturalist for February contains a paper by Lester F. Ward, entitled "Incomplete Adaptation as illustrated by the History of Sex in Plants." In the department devoted to Botany we note "The Fungi which produce Mildew on Cotton Goods." The editor has in preparation a sketch of the Progress of Botany in the United States in the year 1880 and is anxious to procure copies of papers and other publications made during the year

Bulletin of the Torrey Botanical Club for February contains "The Fertilization of Alpine Flowers," by William Trelease; "Preservation of Pileate Fungi for the Herbarium," by W. R. Gerard; "Lists of Local and State Floras" (Middle States).

A List of Plants in Malden and Medford, Mass., etc.—This little catalogue of 20 pages is published by the Middlesex Institute and with alternate blank leaves, is intended to be used as a check list and note book for local collectors.

An Essay on Timber Planting in Ohio, by Dr. Jno. A. Warder. This deserves a fuller notice than our crowded pages will at present allow, but we will make use of it hereafter.

Flora of Indiana.—With this number we issue a small outline map of Indiana to accompany the Catalogue. Upon it will be found the County names and by its help the distribution as indicated in the Catalogue can be clearly seen It should be preserved and bound up with the Catalogue when completed.